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MENDOZAVILITE AND PARAMENDOZAVILITE, TWO NEW MINERALS FROM CUMOBABI, SONORA

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ABSTRACT

Mendozavilita es $Na(Ca, Mg)_2 [Fe_6(PO_4)_2(PMO_{11}O_{39})(OH_1Cl)_{10}].33H_2O$. Su cristalografía no es conocida pero la simetría no es mayor de monoclínica. Las líneas de difracción de rayos X más intensas son 8.77(10), 9.48 (8) y 3.676(5). El color es amarillo, gravedad específica 3.85, dureza 15, biáxico +, con n_x 1.762, n_y 1.763 y n_z 1.766. Paramendozavilita es $NaAl_4 [Fe_7(PO_4)_5 (PMO_{12}O_{40})(OH)_{16}].56H_2O$. Su cristalografía no es conocida pero la simetría no es superior a monoclínica. Las líneas de difracción más intensas son 9.48(10), 7.38 (7), 10.18(6). El color es amarillo claro, gravedad específica 3.35, dureza 1, índices n_x 1.686, n_y 1.710, n_z 1.720. Ambos minerales ocurren en la zona de oxidación del depósito de molibdeno de Cumobabi, cerca de Cumpas, Sonora. Ambas especies y nombres han sido aprobados por la comisión de nuevos minerales de la IMA.

Mendozavilite is $Na(Ca, Mg)_2 [Fe_6(PO_4)_2(PMo_{11}O_{39})(OH,Cl)_{10}].33H_2O$. The crystallography is not known but symmetry is no higher than monoclinic. The strongest X-ray lines (in a complex pattern) are 8.77(10), 9.48 (8), and 3.676(5). The color is yellow, g = 3.85, H = 1.5(Mohs), optically biaxial (+) with n_x = 1.762, n_y = 1.763, n_z = 1.766. Paramendozavilite is $NaAl_4[Fe_7(PO_4)_5 (PMo_{12}O_{40})(OH)_{16}].56H_2O$. The crystallography is not known but symmetry is no higher than monoclinic. The strongest X-ray lines are 9.48(10), 7.38(7), 10.18(6). The color is pale yellow with g = 3.35, H = 1. Indices are n_x = 1.686, n_y - 1.710, n_z = 1.720. Both minerals occur in the oxide zone of the Cumobabi molybdenum deposit near Cumpas, Sonora. Both the species and names have been approved by the commission on new minerals and new mineral names, IMA.

OCCURRENCE

Both minerals were found in the oxide zone of the Cumobabi molybdenum deposit southwest of Cumpas, Sonora. The deposit is in a coarse pegmatitic mass composed of plagioclase, orthoclase, biotite, quartz, and apatite within which are disseminated abundant spectacular masses of molybdenite. The pegmatite lies within a larger body of finer grained granodiorite which locally is enriched in copper. Very little copper occurs in the pegmatite, however, and even pyrite is scarce.

Oxidation produced a welter of secondary molybdenum minerals at the surface, and the oxide zone is bright yellow as a result. The minerals include abundant mendozavilite and paramendozavilite plus at least three other new species. Ferrimolybdite does not occur in this assemblage but it was found at the base of the oxide zone where fresh molybdenite begins to appear.

Mendozavilite occurs chiefly on quartz gangue, usually in the absence of any other minerals. Paramendozavilite occurs only in biotite-rich pegmatite gangue. Crystals often coat bleached biotite which is in the process of decay to supergene kaolinite.

PHYSICAL PROPIERTIES

Mendozavilite is Empire yellow inclining to orange (RHS 11A to 14A) with a bright yellow streak. The luster is vitreous. The specific gravity was determined by Berman balance in toluene as 3.85. The Mohs hardness is 1.5. No fluorescence was observed in-

long or short wavelength UV.

Crystals are biaxial (+) with 2E 5°to 15°. The dispersion r>v is extremely strong. The indices were determined in white light as n_x = 1.762, n_y = 1.763, n_z = 1.766, Crystals are pleochroic in pale yellow with Z>Y>X. In thin section mendozavilite resembles beudantite. Crystals are small (typically 20 microns) but well-formed. The optics indicate low symmetry.

Paramendozavilite is pale yellow (Aureolin RHS 12C) with a very pale yellow streak. The luster is vitreous. The specific gravity is 3.35 (Berman balance in toluene) and Mohs hardness is 1. Prisms of the mineral show one perfect cleavage and extinction is oblique thereto. The indices in white light are n_x = 1.686, n_y = 1.710, n_z = 1.720; optically biaxial (-) with 2E = 60°. Pleochroism is in pale yellow with Z>Y>X. During optical study polysynthetic twinning was observed coincident with the cleavage plane.

CHEMISTRY

Both minerals are readily soluble in all common acids (HCl, HNO_3, H_2SO_4), even in dilute form at room temperature. Because the minerals are so abundant at the locality, and so readily available in pure form, no difficulty was experienced in picking material for analysis. Wet chemical analyses were conducted following a preliminary spectrographic study using DC arc. The results of the analyses are presented in Table One.

It is not an easy task to assign a formula based

TABLE ONE

Chemical Analyses of Mendozavilite and Paramendozavilite

	1	2
Fe_2O_3	14.31	13.36
Al_2O_3	.76	4.65
CaO	2.48	.59
Na_2O	1.25	.54
MgO	.35	.16
P_2O_5	6.78	10.32
MoO_3	50.47	42.01
Cl	.26	.65
H_2O	21.62	28.05
-O=Cl	-.06	-.15
	98.22%	100.18%

1.) Mendozavilite: Fe,P,Ca,Al,Na,Mg,Mo,Cl on 1407 - - micrograms, Fe and P also on 3097 micrograms.

2.) Paramendozavilite: Fe,P,Ca,Mg,Mo,Na,Al,Cl on - - 1054 micrograms, Fe and P also on 2636 micrograms

on the analyses presented. Evidently the compounds are not molybdates but are compounds of a hetero-polyacid P/Mo radical. It this be so, the following formulae can be proposed:

mendozavilite: $Na(Ca,Mg)_2[Fe_6(PO_4)_2(PMo_{11}O_{39})(OH,Cl)_{10}].33H_2O$

paramendozavilite: $NaAl_4\{Fe_7(PO_4)_5(PMo_{12}O_{40})(OH)_{16}\}.56H_2O$

Similar formulae based on structural study have been proposed by Moore and Araki (1977).

X-RAY STUDY

The powder data presented in Table Two were determined in 114mm Gandolfi cameras using CrKα radiation. If the minerals are ground prior to study, additional lines appear but the original lines remain unchanged. Both species give numerous sharp lines of high d value but the patterns deteriorate into a confusing blur of very faint lines at low values. Determined efforts to index the results using the Ito method failed. Considering the optical results, the reason for failure is clearly a problem of low symmetry.

ACKNOWLEDGEMENTS

Mendozavilite is named for the Phelps Dodge geologist H. Mendoza Avila who found the first specimen in company with BaSaw Khin. Paramendozavilite is named for its similarity to the former mineral.

TABLE TWO

X-Ray Powder Data for Mendozavilite and Paramendozavilite

MENDOZAVILITE		PARAMENDOZAVILITE	
dhkl	lest.	dhkl	lest.
11.56	3	14.36	10
9.46	8	12.90	4
8.77	10	10.18	6
5.436	3	9.48	10
4.717	3	8.81	1
4.338	3B	7.98	5
3.676	5	7.38	7
3.542	3	7.16	4
3.118	4	6.56	5
2.990	3	6.27	2
2.829	3	5.466	3
2.728	3	5.003	1
2.610	2	4.728	3B
2.470	1	4.477	1
1.820	5	4.273	1
1.766	3	4.112	1
1.698	1	3.991	1
1.659	1	3.870	2
1.552	4	3.677	1
		3.570	4
		3.460	2
		3.281	3
		3.218	2
		3.136	4

I thank BaSaw Khin for his help in this study, and Mr. Mendoza for arranging a visit to the locality that later produced paramendozavilite. The chemical analyses are the usual impeccable work of Ms. Marjorie Dugan.

Type specimens of both species have been given to the British Museum (N.H.).

REFERENCES

Moore, P. B. and Araki, T. (1977) Inorg. Chem. v. 16 (5), pp. 1096-1106.